

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[FOURTH SERIES.]

No. 95. NOVEMBER 1875.

XXXIX.—*Contributions to the Study of the chief Generic Types of the Palæozoic Corals.* By JAMES THOMSON, F.G.S., and H. ALLEYNE NICHOLSON, M.D., D.Sc., F.R.S.E., Professor of Natural History in the University of St. Andrews.

Introduction.

THE object of the present communication is to consider briefly the characters of the leading *types of structure* which may be recognized amongst the Palæozoic Corals, irrespective of the question as to whether these types constitute what would technically be called "*genera*" or not. Indeed, as we shall hereafter point out at greater length, the modern development of the doctrine of Evolution has rendered any rigid definition of what constitutes a "*genus*" an entire impossibility. So far as this point is concerned, each observer must be left, within certain limits, very much to his own judgment. In carrying out the purpose which we have at present in view, it is most convenient to adopt a stratigraphical rather than a zoological arrangement; and we shall therefore commence with those genera which occur in the Carboniferous period. It may be added that only those types will be considered of which the material now in our hands is sufficient to allow of something like a complete elucidation.

The method of investigation pursued has, in the main, consisted in slicing and polishing the specimens in different directions, and in preparing thin sections for microscopic examination.

Ann. & Mag. N. Hist. Ser. 4. Vol. xvi. 22

amination. It seems almost needless to point out that in this way, and in this way only, can any thing like a complete knowledge be obtained of the actual and essential points of structure in the fossil corals. Due weight, of course, should be given to external characters; but we feel satisfied that the above method of investigation is the only one which is capable of leading to really sound and reliable conclusions, in spite of the great labour and expense which must be attributed as drawbacks to the process. That the general application of this method of investigation to the fossil corals should in some instances yield unexpected results, or possibly even somewhat derange existing classifications, is hardly more than might have been anticipated. At the same time, in accordance with a well-known scientific canon, we should not be justified in hoping that even experts will at first accept all the conclusions at which we have arrived, unless they are willing to adopt the same method of investigation*.

Hitherto the specific determination of the fossil corals of the Palæozoic formations has very frequently been based upon those points of structure or form which can be made out simply by an examination of the external surface, or of fractured specimens. Only in comparatively few instances have observers had recourse to the more complete research implied by the making of properly prepared sections. That the Palæozoic corals form a group in many respects peculiarly difficult to study cannot be denied; but we believe that the difficulties of the case have been much increased by the imperfect modes of investigation which have been in general employed. To this it must be added that few collections of Palæozoic corals, either public or private, are at present in such a condition as to admit satisfactorily of critical study.

The generic distinctions amongst the Palæozoic corals have usually been based upon the characters of the septal system, the presence or absence of a columella and its characters when present, the existence or non-existence of dissepiments and their form and disposition when present, the nature of the tabulæ, the characters of the wall and exothecal structures, and the general form and mode of growth of the corallum.

* Our collections embrace several thousands of cut and polished specimens of the Palæozoic corals, together with a large number of thin sections for microscopic examination, irrespective of very many that have been left in their native condition. No one, who has not learnt by actual experience, can properly appreciate the great expenditure of time, labour, and money involved in thus preparing for examination a large series of fossil corals. Even as it is, much of the material in our hands is still comparatively unavailable from its not having been submitted to these necessary preliminaries.

No one of these characters, however, can be safely relied upon as, of itself, sufficient for generic distinction; and it seems certain that genera should be founded upon a due consideration and estimation of *all* the morphological characters of the corallum.

As investigated by the method which we have employed, the corals of the Palæozoic period very strongly support the view that they owe their structural peculiarities to some form or another of evolution. Whenever a sufficiently large number of specimens of any given group can be obtained, and submitted to examination by means of sections, a complete passage is usually found to exist into other allied groups. So complete is this transition, and so gradual are the steps by which it is effected, that it becomes impossible for the most painstaking observer to draw any hard-and-fast line of demarcation between such inosculating groups. On the contrary, he is constantly confronted with examples that might be indifferently referred to one or the other of two groups, and which he therefore finds it impossible to place definitely otherwise than as central links in a connected series.

Whilst the important result just enunciated is in many instances capable of complete demonstration, it nevertheless remains certain that in all such anastomosing groups it is possible to pick out certain examples which may be regarded as representatives or *type forms* of the groups. Such forms constitute centres from which their respective groups diverge in different directions; and they are not only constant in their characters, but differ from the intermediate forms in being readily and certainly recognizable, and capable of easy reference to a definite position.

It seems almost unnecessary to mention that these results are not only precisely what would have been expected upon any theory of Evolution, but that they are in complete accordance with the results arrived at by observers in other departments. We may instance more especially the Foraminifera, the Ostracoda, and the Graptolitidæ in support of this statement. Upon any theory of Evolution, allied groups must be linked together by a more or less crowded series of intermediate forms. The advocates of all hypotheses of this nature are therefore compelled to hold that genera and species are merely arbitrary divisions, and that they cease to have any existence in reality the moment we obtain a complete series of transitional forms.

It still remains to consider the course which should be adopted *in practice*, when we come to deal with these connected and inosculating groups for the purpose of systematic

study. One course would be to throw all such forms together, as constituting a single "genus," and to consider the different types of the series as so many "subgenera." The objections to this course, however, are twofold. In the first place, as our knowledge increases, and as we obtain a more complete series of forms uniting different groups together, our genera would undergo a proportionate expansion and increase of size, until, in the case of fossil forms at any rate, they would become utterly unmanageable. A "genus" might in this way come ultimately to include all the forms which now constitute a "family;" and from the number and variety of the forms included in it, there would be great difficulty in giving it any precise definition. In the second place, "subgenera," however appropriate and justifiable in theory, are nearly useless, if not absolutely obstructive, in actual practice. We think most working naturalists will bear us out in this view, at any rate so far as concerns all cases where we cannot obtain *complete* materials for determination and examination, as we never can in the case of fossils.

On the other hand, the course may be adopted of selecting certain well-marked and easily recognizable "types," and of giving to these distinctive names. By adopting such a course the actual practical work of determining and classifying specimens is enormously facilitated; and it does not matter to the observer, though his "types" be connected together by a gradational series of transitional forms. He does not thereby hamper his theoretical conceptions as to what constitutes a "genus" or a "species;" nor is he pledged to believe that his selected types are all of the same value. He is not even bound to express a positive opinion as to whether his "types" are to be regarded as "genera" or as "subgenera." This, indeed, must be a comparative matter of indifference to him, since, upon all theories of Evolution, these terms are of merely conventional value, elastic, and incapable of precise definition, and owing their existence at all, in any definite form, to our own imperfect knowledge. Nor does it seem that the reproach can justly be made that the adoption of this course opens the door to a wide and undesirable multiplication of names. "Subgenera" have distinctive names applied to them just as much as "genera," with the disadvantage that they are infinitely more perplexing and more difficult to work with.

In working out the Palæozoic corals we have thought it best to adopt the course above indicated. We have chosen certain structural "types," which the observer can always recognize with certainty when he is provided with properly prepared specimens; and to these we have given distinctive

names, where such did not exist before. We do not for a moment deny that in many instances these types can be shown to pass into others by regular and almost imperceptible gradations, and that possibly all of them may, some day, be shown to be similarly connected with one another. Nor are we prepared to maintain that all these types, even where they have by common consent been regarded as of generic value, are so distinctively separated from others as to deserve the name of "genera," in the ordinary acceptation of this term. We have had, however, to face a difficulty which will increasingly meet the worker in any department of Invertebrate Palæontology; and we think that this is, in the meanwhile, the best practical solution of it. Even if a better solution of the difficulty be ultimately found, no retardation or impediment to the progress of science in this department will result from our present adoption of this course. No type will be described by us which is not at the same time accurately figured; and the *facts* thus recorded will remain unchanged, and will retain their value, whatever alteration may take place in our method of interpreting them.

[To be continued.]

XL.—*Descriptions of new Mammalia from Persia and Balú-chistán.* By W. T. BLANFORD, F.R.S.

THE following descriptions have been in print for more than a year; but, owing to unforeseen delays, the work on Persian zoology in which they appear has not yet been published, and it is, I hear, likely that some time must elapse before it will be ready. Under these circumstances it appears to me desirable to describe the species of *Mammalia* supposed to be new, so as to avoid confusion of synonymy from the delay.

1. *Vespertilio desertorum*, Dobson, MS.

V. fusco-fulvus; auribus magnis, ad apices rotundatis, margine exteriori juxta apicem emarginata, inde ad basin tragi recta, concha punctis glandularibus confertim instructa; trago longo, angusto, acuto, margine interiori convexiuscula, exteriori concava; digitis tertio quartoque fere æqualibus; vertebra ultima caudæ membranam excedente; alis a basi digitorum pedum orientibus.

Long. corporis cum capite 2·1, caudæ 1·65, auris 0·65, tragi 0·35, radii 1·65, tibiæ 0·8 poll. Angl.

Hab. ad Jalk, Balúchistán.